Probabilistic Tsunami Hazard Analysis

Hong Kie Thio

URS corp

The large personal and material losses due to tsunami disasters over the last decade have accelerated the development of performance-based solutions to the problem of tsunami hazard impact and thus the establishment of a probabilistic framework for tsunami hazard analysis. We have developed a method for Probabilistic Tsunami Hazard Analysis (PTHA) that closely follows, where possible, the approach in Probabilistic Seismic Hazard Analysis (PSHA) using a two-step approach.

In the first step, we compute fully probabilistic offshore waveheights, taking advantage of the linear behavior of tsunami waves in the open ocean. We use a library of pre-computed tsunami Green's functions for small (50x50 km) subfaults from all potential sources in and around the Pacific basin, which allows us to integrate over a wide range of locations and magnitudes, similar to PSHA, and also incorporate epistemic uncertainties through the use of logic trees and aleatory uncertainties using distribution functions. We have also included tidal variations by convolving the computed timeseries with local tidal records.

In the second step, we compute inundation scenarios from a small subset of events, based on source disaggregation, that are representative of the hazard expressed by the probabilistic waveheights derived earlier. This process has enabled us to develop probabilistic tsunami inundation maps for California, which show the inundation limits for different return periods (72, 475, 975 and 2475 yr), and will also feature exceedance flow depths. These maps have been computed for most of the populated parts of the California coast with a resolution of thirty meters using the detailed grids developed by NOAA.